

PATENT APPLICATION

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re application of

Docket No: Q73220

Byung-sun CHOI, et al.

Appln. No.: 10/608,411

Group Art Unit: 2621

Confirmation No.: 8067

Examiner: Tung T. VO

Filed: June 30, 2003

For: TRANSCODING APPARATUS AND METHOD, AND TARGET BIT ALLOCATION
AND PICTURE COMPLEXITY ESTIMATION APPARATUS AND METHODS USED
FOR THE SAME

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

MAIL STOP APPEAL BRIEF - PATENTS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the provisions of 37 C.F.R. § 41.37, Appellant submits the following:

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I. REAL PARTY IN INTEREST

The real party in interest is SAMSUNG ELECTRONICS CO., LTD., (Assignee) by virtue of an assignment executed by a joint inventor (Appellant), Byung-sun CHOI, on December 1, 2003, and recorded by the Assignment Branch of the U.S. Patent and Trademark Office on April 23, 2004 (at Reel 015261, Frame 0248) and an assignment executed by a joint inventor Jun XIN executed on November 2, 2005, and filed at the U.S. Patent and Trademark Office on June 27, 2007.

II. RELATED APPEALS AND INTERFERENCES

Appellant submits that the claims were rejected in a Final Office issued April 24, 2007.

An Advisory Action was issued on July 12, 2007. In response, the Appellant filed a Notice of Appeal on August 24, 2007.

Upon information and belief, there are no other pending appeals, interferences, or judicial proceedings known to Appellant, Appellant's representatives or the Assignee that may be related to, be directly affected by, or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-3, 5-13, 15-18, 20-23 and 25-45 are all the claims pending in the application.

Claims 1, 3, 7, 9, 10, 12, 13, 17, 18, 22, 23, 27, 29, 30, and 32-35 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,915,018 (hereinafter, “Tajime”).

Claim 2 is rejected under 35 U.S.C. § 103(a) over Tajime in view of Kim (U.S. Patent Publication No. 2002/0126752; hereinafter “Kim”).

Claims 5, 6, 8, 11, 15, 16, 20, 21, 25, 26, 28, 31, 36-45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

Claims 1-3, 5-13, 15-18, 20-23 and 25-45, which have been at least twice rejected, are the claims on appeal (See Claims Appendix).

IV. STATUS OF AMENDMENTS

Claims 1-3, 5-13, 15-18, 20-23 and 25-45, have not been amended subsequent to the final rejection of April 24, 2007.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates to transcoding, and more particularly, to picture complexity estimation in transcoding, and target bit-allocation for controlling bit-rate during transcoding. ¶ 2 of Appellant's Specification and Fig. 6.

Independent claim 1 is directed to “[a] transcoding apparatus comprising: a video decoding unit which receives compressed bitstream and performs decoding thereof to output decoded pictures” (¶ 44 and Fig. 6). Claim 1 recites “a complexity estimation unit which estimates complexity of a current picture among the decoded pictures to encode the current picture,” (¶ 46 and Fig. 6) “a target bit-allocation unit which performs desired bit-allocation using the complexity information of the current picture,” (¶50 and Fig. 6) “a bit-rate control unit which controls bit-rate using bit-allocation information and state information from memory, which outputs an encoded bitstream,” (¶51 and Fig. 6) and “a video encoding unit which encodes the decoded pictures on the basis of the bit-allocation and state information of the bit-rate control unit,” (¶51 and Fig. 6) “wherein the complexity estimation unit calculates complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures output from the video decoding unit and complexity of an encoded previous picture output from the video encoding unit” (¶46 and Fig. 6).

Independent claim 9 is directed to “[a] unit for estimating complexities of pictures, the unit comprising a decoded picture information receiving unit which receives complexity information of decoded previous and current pictures,” (¶ 45, 46 and 50, and Fig. 6) “an encoded picture information receiving unit which receives complexity information of an encoded previous picture,” (¶ 45, 46 and 50, and Fig. 6) and “a complexity estimation unit, which estimates complexity of a picture to be currently encoded, using the complexity of the decoded

previous and current pictures and the complexity of the encoded previous picture” (¶ 46 and Fig. 6).

Independent claim 12 is directed to “[a] bit-allocation unit comprising: a complexity estimation unit which receives a compressed bitstream, performs decoding thereof, outputs decoded pictures, and estimates complexity of a current picture among the decoded pictures,” (¶ 46 and Fig. 6) “and a bit-allocation unit which performs desired bit-allocation using the complexity of the current picture,” (¶ 50 and Fig. 6) and “wherein the complexity estimation unit calculates complexity of a picture to be currently encoded, using complexity of a decoded previous and current pictures and complexity of an encoded previous picture” (¶46-50 and Fig. 6).

Independent claim 17 is directed to “[a] bit-allocation method comprising: receiving a compressed bitstream, performing decoding thereof, outputting decoded pictures, and estimating complexity of a current picture among the decoded pictures,” (¶53 and Fig. 8) “performing desired bit-allocation using the complexity information of the current picture,” (¶54 and Fig. 8) and “wherein in estimating the complexity of the current picture, complexity of a picture to be currently encoded is calculated using complexity of decoded previous and current pictures and complexity of an encoded previous picture” (¶ 53-54 and Fig. 8).

Independent claim 22 is directed to “[a] transcoding method comprising: receiving a compressed bitstream and performing decoding thereof to output decoded pictures,” (¶53 and Fig. 8), “estimating complexity of a current picture among the decoded pictures,” (¶53 and Fig. 8) “performing desired bit-allocation using the complexity of the current picture,” (¶54 and Fig. 8) “controlling bit-rate using bit-allocation information and state information from memory, which outputs encoded bitstream,” (¶54 and Fig. 8) “encoding the decoded pictures on the basis of the bit-allocation and state information,” (¶54 and Fig. 8) and “wherein in estimating the complexity of the current picture, complexity of a picture to be currently encoded is calculated, using

complexity of a decoded previous and current pictures, and complexity of an encoded previous picture (¶53-54 and Fig. 8).

Independent claim 29 is directed to “[a] method for estimating complexities of pictures, the method comprising: receiving complexity information of decoded previous and current pictures,” (¶53 and Fig. 8) “receiving complexity information of an encoded previous picture,” and (¶53 and Fig. 8) “estimating complexity of a current picture to be encoded, using the complexity information of the decoded previous and current pictures and the complexity information of the encoded previous picture” (¶53, 54 and 58 and Fig. 8).

Independent claim 32 is directed to “[a] computer readable medium having embodied thereon a computer program for enabling a computer to execute a transcoding method, the method comprising: receiving a compressed bitstream and performing decoding thereof to output decoded pictures,” (¶53, 54, 58 and Fig. 8) “estimating complexity of a current picture among the decoded pictures using a complexity information of a decoded previous picture, a complexity information of a decoded current picture and a complexity information of an encoded previous picture,” (¶53 and Fig. 8) “performing desired bit-allocation using the complexity of the current picture; controlling bit-rate using bit-allocation information and state information from memory, which outputs an encoded bitstream; and encoding the decoded pictures on the basis of the bit-allocation and state information” (¶53 and 54 and Fig. 8).

Independent claim 33 is directed to “[a] computer readable medium having embodied thereon a computer program for enabling a computer to execute a picture complexity estimation method, the method comprising: receiving complexity information of decoded previous and current pictures,” (¶53 and 58, and Fig. 8) “receiving complexity information of an encoded previous picture,” (¶53 and Fig. 8) “estimating complexity of a current picture to be encoded, using the complexity information of the decoded previous and current pictures and the complexity information of the encoded previous picture” (¶53 and 54, and Fig. 8).

Independent claim 34 is directed to “[a] computer readable medium having embodied thereon a computer program for enabling a computer to execute a bit-allocation method, the method comprising: receiving a compressed bitstream, performing decoding thereof, outputting decoded pictures,” (¶53 and 58, and Fig. 8) “estimating complexity of a current picture among the decoded pictures using a complexity information of a decoded previous picture, a complexity information of a decoded current picture and a complexity information of an encoded previous picture,” (¶53 and Fig. 8) and “performing desired bit-allocation using complexity of the current picture” (¶54 and Fig. 8).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 3, 7, 9, 10, 12, 13, 17, 18, 22, 23, 27, 29, 30, and 32-35 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,915,018 (hereinafter, “Tajime”).
Claim 2 is rejected under 35 U.S.C. § 103(a) over Tajime in view of Kim (U.S. Patent Publication No. 2002/0126752; hereinafter “Kim”).

VII. ARGUMENT

A. Summary of Rejection

On pages 2-3 of the Final Office Action of April 24, 2007, the Examiner alleges that:

Tajime teaches the complexity estimation unit (101 of fig. 1) calculates complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures output from the video decoding unit (11 of fig. 1, Note I, P, B pictures of MPEG) and the complexity estimation unit (101 of fig. 2) also calculates complexity of an encoded previous picture output from the video encoding unit (col. 10, lines 23-33), and the complexity measure in all pictures (col. 10, lines 11-18).

Further, the Examiner states on page 3 of the Final Office Action that:

[s]ince Jajime [sic] teaches the complexity estimation unit (101 of figs. 1 and 2) calculates the complexity of the decoded pictures (11 of fig. 1), the complexity of the encoded picture (13 of fig. 2), and the complexity measure in all pictures (col. 10, lines 11-18) and suggests various embodiments are possible within the scope of the essentials of the disclosure (col. 14, lines 55-57), so this is evident to one of ordinary skill in the art to combine the teachings of figures 1 and 2 of Tajime together in order to improve the complexity measurement. In view of the discussion above, the claimed features are unpatentable over Tajime.

B. Claim 1 is Not Disclosed by Tajime

Appellant respectfully submits that claim 1 is patentable because a *prima facie* case of obviousness has not been established. Claim 1 recites:

A transcoding apparatus comprising:
a video decoding unit which receives compressed bitstream and performs decoding thereof to output decoded pictures;

a complexity estimation unit which estimates complexity of a current picture among the decoded pictures to encode the current picture;

a target bit-allocation unit which performs desired bit-allocation using the complexity information of the current picture;

a bit-rate control unit which controls bit-rate using bit-allocation information and state information from memory, which outputs an encoded bitstream; and

a video encoding unit which encodes the decoded pictures on the basis of the bit-allocation and state information of the bit-rate control unit,

wherein the complexity estimation unit calculates complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures output from the video decoding unit and complexity of an encoded previous picture output from the video encoding unit.

For example, Tajima fails to disclose, inter alia, an apparatus wherein:

the complexity estimation unit calculates complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures output from the video decoding unit and complexity of an encoded previous picture output from the video encoding unit.

The sections and the reference number 101 of Tajime cited by the Examiner as allegedly disclosing the claimed complexity estimation unit, disclose a complexity measure computing means 101. Col. 8, lines 45-67, col. 10, lines 23-33 and Fig. 1. Tajime discloses that the complexity measure computing means 101 calculates a complexity measure X_p of a picture group and a complexity measure X_t in all pictures.

First, Appellant respectfully submits that i) the complexity measure X_p of a picture group and ii) the complexity measure X_t in all pictures in column 8, lines 11-18 of Tajime fail to teach

the complexity measure for both the decoded previous picture and the decoded current picture, as recited in claim 1.

Tajime discloses the calculation of the complexity measure Xp of a picture group through equations (1)-(3):

$$Qop = \sum_{j=1}^{Npx \times Nmb} Qoj \quad (1)$$

$$Sop = \sum_{j=1}^{Npx \times Nmb} Soj \quad (2)$$

$$Xp = \frac{Qop \times Sop}{Np^2 \times Nmb} \quad (3)$$

As explained in column 8, lines 51-61, Qop is the quantizer step size cumulative value for all macroblocks of the group of pictures and Sop is the number of bits cumulative value for all macroblocks of the group of pictures.

As shown in the equation above, the quantizer step size cumulative value for all macroblocks of the group of pictures Qop is calculated by summing up a number of the quantizer step size cumulative values for the group of pictures. Similarly, the number of bits cumulative value for all macroblocks of the group of pictures Sop is calculated by summing up a number of values for all macroblocks of the group of pictures. The Qop and the Sop are then used in equation 3 to calculate a single complexity measure Xp of a picture group. In other words, Xp does not represent a complexity measure of a single picture.

For example, if there are only two pictures in the plurality of pictures, i.e., a previous picture and a current picture, Tajime teaches calculating a single complexity measure using the quantizer step size cumulative value of the macroblocks of the previous and the current pictures and the number of bits cumulative value of the macroblocks of the previous and the current pictures. In other words, Tajime does not teach the calculation of one complexity measure for the previous picture and the calculation of another complexity measure for the current picture. Rather, Tajime teaches a single value, Xp , that represents the complexity measure of a group of pictures.

Similarly, the complexity measure Xt in all pictures cannot possibly disclose the claimed complexity of decoded previous and current pictures and complexity of an encoded previous picture, since the complexity measure Xt in all pictures does not represent the complexity of a single picture, but the complexity of all pictures.¹

In view of the above, Appellant respectfully submits that the complexity measure computing means 101 of Tajime cannot possibly disclose complexity estimation unit which calculates complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures output from the video decoding unit, in combination with other elements of claim 1.

¹ Tajime discloses equations (4)-(6) that are similar to equations (1)-(3) to show that the complexity measure Xt in all pictures is based on values calculated from all pictures:

$$Qot = \sum_{j=1}^{Npx \times Nmb} Qoj \quad (4)$$

$$Sot = \sum_{j=1}^{Npx \times Nmb} Soj \quad (5)$$

$$Xt = \frac{Qot \times Sot}{N^2 \times Nmb} \quad (6)$$

Second, Appellant respectfully submits that any modification of Tajime fails to establish a *prima facie* case of obviousness. In the Final Office Action, the Examiner states that it would have been obvious to combine the teachings of the first embodiment (calculating complexity of decoded pictures) shown in Fig. 1 and the second embodiment (calculating complexity of re-encoded pictures) shown in Fig. 2. See p. 3 of Final Office Action.

Even if assuming *arguendo*, that the complexity measure computing means 101 of Tajime discloses calculating the complexity of individual pictures, Supreme Court precedent strongly supports Appellant's position that the modification of Tajime espoused by the Examiner would not be obvious to one skilled in the art.

In *KSR Int'l v. Teleflex, Inc.*, the Supreme Court held that "a combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." a combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 2007 U.S. LEXIS 4745, 8 (U.S. 2007).

According to the Examiner, Figure 1 of Tajime discloses calculating the complexity of decoded pictures and Figure 2 of Tajime discloses calculating the complexity of encoded pictures. The Examiner, however, has not shown how the complexity measure computing means 101 would calculate the claimed complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures output from the video decoding unit and complexity of an encoded previous picture output from the video encoding unit.

In an exemplary embodiment, Equation 3 in on page 13 of the Appellant's specification discloses a way to calculate the complexity value using the complexity of the decoded current

picture, the complexity of the decoded previous picture, and the complexity of the previous picture after encoding.

In contrast, Tajime does not show, nor does the Examiner proffer, any explanation of how the complexity measures from the decoded pictures and the complexity of the re-encoded pictures would be combined. Without any explanation, the combination of the first and second embodiments do not yield predictable results to render claim 1 obvious.

For reasons similar to those submitted for claim 1, claims 9, 12, 17, 22, 29 and 32-34 are patentable.

Claims 3, 7 and 35, which depend from claim 1, claim 10, which depends from claim 9, claim 13, which depends from claim 12, claim 18, which depends from claim 17, claims 23 and 27, which depend from claim 22, and claim 30, which depends from claim 29, are patentable for at least the reasons submitted for their respective base claims.

C. Conclusion

Appellant submits that the Examiner is attempting to arbitrarily characterize the teachings of Tajime as corresponding to the features of claims 1, 9, 12, 17, 22, 29 and 32-34 in a manner that is inconsistent with the disclosure of Tajime. Therefore, each and every element of the independent claims 1, 9, 12, 17, 22, 29 and 32-34 are not disclosed by Tajime.

Claim 2, which depends from claim 1, is patentable for at least the reasons submitted for claim 1.

Accordingly, Appellant hereby submits that the Examiner has failed to establish a *prima facie* case of obviousness to show that claims 1, 3, 7, 9, 10, 12, 13, 17, 18, 22, 23, 27, 29, 30, and

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32-35 are unpatentable over Tajime, as required under 35 U.S.C. § 103, and hereby submits that claims 1, 3, 7, 9, 10, 12, 13, 17, 18, 22, 23, 27, 29, 30, and 32-35 are patentable.

At least by virtue of its dependency from claim 1, claim 2 is patentable over Tajime in view of Kim.

Unless a check is submitted herewith for the fee required under 37 C.F.R. §41.37(a) and 1.17(c), please charge said fee to Deposit Account No. 19-4880.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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CLAIMS APPENDIX

CLAIMS 1-3, 5-13, 15-18, 20-23, 25-41, 43-45 ON APPEAL:

1. A transcoding apparatus comprising:

a video decoding unit which receives compressed bitstream and performs decoding thereof to output decoded pictures;

a complexity estimation unit which estimates complexity of a current picture among the decoded pictures to encode the current picture;

a target bit-allocation unit which performs desired bit-allocation using the complexity information of the current picture;

a bit-rate control unit which controls bit-rate using bit-allocation information and state information from memory, which outputs an encoded bitstream; and

a video encoding unit which encodes the decoded pictures on the basis of the bit-allocation and state information of the bit-rate control unit,

wherein the complexity estimation unit calculates complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures output from the video decoding unit and complexity of an encoded previous picture output from the video encoding unit.

2. The transcoding apparatus of claim 1, further comprising an output buffer which stores and outputs pictures encoded by the video encoding unit, wherein state information of the output buffer is provided to the bit-rate control unit.

3. The transcoding apparatus of claim 1, wherein the compressed bitstream input to the video decoding unit is compressed in MPEG (Motion Picture Experts Group) format.

5. The transcoding apparatus of claim 1, wherein if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, the complexity estimation unit calculates $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

6. The transcoding apparatus of claim 1, wherein the bit-allocation unit increases a number of bits to be allocated for the current picture if complexity of an estimated current picture

is large, and decreases number of bits to be allocated for the current picture if the complexity of the estimated current picture is small.

7. The transcoding apparatus of claim 1, wherein the target bit-allocation unit calculates a number of bits to be allocated for the current picture using the complexity of the current picture

8. The transcoding apparatus of claim 1, wherein the bit-allocation unit calculates a number of bits T_I to be allocated for a current I picture, using the complexity of the current picture, as follows:

$$T_I = \frac{\hat{X}_{out,I}}{\hat{X}_{out,I} + \sum_{i=1}^{N_p} \hat{X}_{out,P}[i] + \sum_{j=1}^{N_B} \hat{X}_{out,B}[j]} \times T_{GOP},$$

wherein, \hat{X}_{out} denotes complexity of a picture to be currently encoded, N_p denotes a number of P pictures in a GOP (group of pictures), and N_B denotes a number of B pictures in the GOP.

9. An unit for estimating complexities of pictures, the unit comprising:
a decoded picture information receiving unit which receives complexity information of decoded previous and current pictures;
an encoded picture information receiving unit which receives complexity information of an encoded previous picture; and

a complexity estimation unit, which estimates complexity of a picture to be currently encoded, using the complexity of the decoded previous and current pictures and the complexity of the encoded previous picture.

10. The estimating unit of claim 9, wherein the encoded picture is compressed in MPEG format.

11. The estimating unit of claim 9, wherein if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, the complexity estimation unit calculates $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

12. A bit-allocation unit comprising:

a complexity estimation unit which receives a compressed bitstream, performs decoding thereof, outputs decoded pictures, and estimates complexity of a current picture among the decoded pictures; and

a bit-allocation unit which performs desired bit-allocation using the complexity of the current picture,

wherein the complexity estimation unit calculates complexity of a picture to be currently encoded, using complexity of a decoded previous and current pictures and complexity of an encoded previous picture.

13. The bit-allocation unit of claim 12, wherein the compressed bitstream is compressed in MPEG format.

15. The bit-allocation unit of claim 12, wherein if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, the complexity estimation unit calculates $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B}$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

16. The bit-allocation unit of claim 12, wherein the target bit-allocation unit calculates a number of bits T_I to be allocated to a current I picture, using the complexity of the current picture, as follows:

$$T_I = \frac{\hat{X}_{out,I}}{\hat{X}_{out,I} + \sum_{i=1}^{N_p} \hat{X}_{out,P}[i] + \sum_{j=1}^{N_B} \hat{X}_{out,B}[j]} \times T_{GOP},$$

wherein, \hat{X}_{out} denotes complexity of a picture to be currently encoded, N_p denotes a number of P pictures in a GOP (group of pictures), and N_B denotes a number of B pictures in the GOP.

17. A bit-allocation method comprising:

receiving a compressed bitstream, performing decoding thereof, outputting decoded pictures, and estimating complexity of a current picture among the decoded pictures; and performing desired bit-allocation using the complexity information of the current picture, wherein in estimating the complexity of the current picture, complexity of a picture to be currently encoded is calculated using complexity of decoded previous and current pictures and complexity of an encoded previous picture.

18. The bit-allocation method of claim 17, wherein the compressed bitstream is compressed in MPEG format.

20. The bit-allocation method of claim 17, wherein in estimating the complexity of the current picture, if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$ are calculated, respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

21. The bit-allocation method of claim 17, wherein in performing the desired bit-allocation, a number of bits to be allocated to a current I picture is calculated, using the complexity of the current picture, as follows:

$$T_I = \frac{\hat{X}_{out,I}}{\hat{X}_{out,I} + \sum_{i=1}^{N_p} \hat{X}_{out,P}[i] + \sum_{j=1}^{N_B} \hat{X}_{out,B}[j]} \times T_{GOP},$$

wherein, \hat{X}_{out} denotes complexity of a picture to be currently encoded, N_p denotes a number of P pictures in a GOP (group of pictures), and N_B denotes a number of B pictures in the GOP.

22. A transcoding method comprising:

receiving a compressed bitstream and performing decoding thereof to output decoded pictures;

estimating complexity of a current picture among the decoded pictures;

performing desired bit-allocation using the complexity of the current picture;

controlling bit-rate using bit-allocation information and state information from memory, which outputs encoded bitstream; and

encoding the decoded pictures on the basis of the bit-allocation and state information,

wherein in estimating the complexity of the current picture, complexity of a picture to be currently encoded is calculated, using complexity of a decoded previous and current pictures, and complexity of an encoded previous picture.

23. The transcoding method of claim 22, wherein the compressed bitstream is compressed in MPEG format.

25. The transcoding method of claim 22, wherein in estimating the complexity of the current picture, if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, are calculated respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

26. The transcoding method of claim 22, wherein in performing the desired bit-allocation, a number of bits to be allocated to the current picture is increased if the complexity of the current picture is large, and the number of bits to be allocated to the current picture is decreased if the complexity of the current picture is small.

27. The transcoding method of claim 22, wherein in performing the desired bit-allocation, a number of bits to be allocated to the current picture is estimated using the complexity of the current picture.

28. The transcoding method of claim 22, wherein in performing the desired bit-allocation, a number of bits T_I to be allocated to a current I picture is calculated, using the complexity of the current picture, as follows:

$$T_I = \frac{\hat{X}_{out,I}}{\hat{X}_{out,I} + \sum_{i=1}^{N_p} \hat{X}_{out,P}[i] + \sum_{j=1}^{N_B} \hat{X}_{out,B}[j]} \times T_{GOP},$$

wherein, \hat{X}_{out} denotes complexity of a picture to be currently encoded, N_p denotes a number of P pictures in a GOP (group of pictures), and N_B denotes a number of B pictures in the GOP.

29. A method for estimating complexities of pictures, the method comprising:
receiving complexity information of decoded previous and current pictures;
receiving complexity information of an encoded previous picture; and
estimating complexity of a current picture to be encoded, using the complexity information of the decoded previous and current pictures and the complexity information of the encoded previous picture.

30. The complexity estimating method of claim 29, wherein the encoded picture is compressed in MPEG format.

31. The complexity estimating method of claim 29, wherein in estimating the complexity of the current picture, if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, $\hat{X}_{out,B}$, $\hat{X}_{out,I}$, and $\hat{X}_{out,P}$, are calculated respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

32. A computer readable medium having embodied thereon a computer program for enabling a computer to execute a transcoding method, the method comprising:
receiving a compressed bitstream and performing decoding thereof to output decoded pictures;

estimating complexity of a current picture among the decoded pictures using a complexity information of a decoded previous picture, a complexity information of a decoded current picture and a complexity information of an encoded previous picture;

performing desired bit-allocation using the complexity of the current picture;

controlling bit-rate using bit-allocation information and state information from memory, which outputs an encoded bitstream; and

encoding the decoded pictures on the basis of the bit-allocation and state information.

33. A computer readable medium having embodied thereon a computer program for enabling a computer to execute a picture complexity estimation method, the method comprising:

receiving complexity information of decoded previous and current pictures;

receiving complexity information of an encoded previous picture; and

estimating complexity of a current picture to be encoded, using the complexity information of the decoded previous and current pictures and the complexity information of the encoded previous picture.

34. A computer readable medium having embodied thereon a computer program for enabling a computer to execute a bit-allocation method, the method comprising:

receiving a compressed bitstream, performing decoding thereof, outputting decoded pictures;

estimating complexity of a current picture among the decoded pictures using a complexity information of a decoded previous picture, a complexity information of a decoded current picture and a complexity information of an encoded previous picture; and

performing desired bit-allocation using complexity of the current picture.

35. The transcoding apparatus of claim 1 wherein the complexity estimation unit calculates the complexity of the current picture using information decoded by the video decoding unit and encoded information at a previous time.

36. The transcoding method of claim 22, wherein the complexity of the current picture among the decoded pictures is estimated by calculating the complexity of the current picture using information obtained by decoding the compressed bitstream and encoded information at a previous time.

37. The transcoding apparatus of claim 1, wherein the complexity estimation unit estimates the complexity of the current picture based on a product of the complexity of the decoded current picture and a ratio of the complexity of the encoded previous picture of the current picture to the complexity of the decoded previous picture of the current picture.

38. The estimating unit of claim 9, wherein the complexity estimation unit estimates the complexity of the current picture based on a product of the complexity of the decoded current picture and a ratio of the complexity of the encoded previous picture of the current picture to the complexity of the decoded previous picture of the current picture.

39. The bit-allocation unit of claim 12, wherein the complexity estimation unit estimates the complexity of the current picture based on a product of the complexity of the decoded current picture and a ratio of the complexity of the encoded previous picture of the current picture to the complexity of the decoded previous picture of the current picture.

40. The bit-allocation method of claim 17, wherein the estimating the complexity of the current picture comprises determining the complexity of the current picture based on a product of the complexity of the decoded current picture and a ratio of the complexity of the encoded previous picture of the current picture to the complexity of the decoded previous picture of the current picture.

41. The transcoding method of claim 22, wherein the estimating complexity of the current pictures comprises determining the complexity of the current picture based on a product of the complexity of the decoded current picture and a ratio of the complexity of the encoded previous picture of the current picture to the complexity of the decoded previous picture of the current picture.

42. The complexity estimating method of claim 29, wherein the estimating the complexity of the current picture to be encoded comprises determining the complexity of the current picture based on a product of the complexity information of the decoded current picture and a ratio of the complexity information of the encoded previous picture to the complexity information of the decoded previous picture.

43. The computer readable medium of claim 32, wherein the estimating the complexity of the current picture comprises determining the complexity of the current picture based on a product of the complexity of the decoded current picture and a ratio of the complexity of the encoded previous picture of the current picture to the complexity of the decoded previous picture of the current picture.

44. The computer readable medium of claim 33, wherein the estimating the complexity of the current picture to be encoded comprises determining the complexity of the current picture based on a product of the complexity information of the decoded current picture and a ratio of the complexity information of the encoded previous picture to the complexity information of the decoded previous picture.

45. The computer readable medium of claim 34, wherein the estimating the complexity of the current picture comprises determining the complexity of the current picture based on a product of the complexity of the decoded current picture and a ratio of the complexity of the encoded previous picture of the current picture to the complexity of the decoded previous picture of the current picture.

EVIDENCE APPENDIX:

This Appendix is not applicable to this Appeal.

RELATED PROCEEDINGS APPENDIX

This Appendix is not applicable to this Appeal.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

Docket No: Q73220

Byung-sun CHOI, et al.

Appln. No.: 10/608,411

Group Art Unit: 2621

Confirmation No.: 8067

Examiner: Tung T. VO

Filed: June 30, 2003

For: TRANSCODING APPARATUS AND METHOD, AND TARGET BIT ALLOCATION
AND PICTURE COMPLEXITY ESTIMATION APPARATUS AND METHODS USED
FOR THE SAME

SUBMISSION OF APPEAL BRIEF

MAIL STOP APPEAL BRIEF - PATENTS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith please find an Appeal Brief. The statutory fee of \$510.00 is being charged to Deposit Account No. 19-4880 via EFS Payment Screen. The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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CUSTOMER NUMBER

Date: December 26, 2007